

WHAT IS CLAIMED:

1. A liquid antiozonant mixture obtained from the process comprising simultaneously reacting at least one unsubstituted and/or substituted paraphenylenediamine compound of the general formula



wherein R^1 and R^2 are the same or different and are hydrogen, a branched or straight chain alkyl, alkenyl, alkoxyl, aralkyl, alkaryl, hydroxyalkyl or heterocyclic; with a carbonyl compound mixture comprising acetone and at least one other carbonyl compound selected from the group consisting of ketones containing from 4 to about 12 carbon atoms, aldehydes containing from 1 to about 12 carbon atoms and mixtures thereof in the presence of a reductive alkylation catalyst.

2. The antiozonant mixture of Claim 1 wherein the paraphenylenediamine compound is selected from the group consisting of paraphenylenediamine, paraaminodiphenylamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine; N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N-di-beta-naphthyl-p-phenylenediamine, N-o-tolyl-N'-phenyl-p-phenylenediamine, N,N-di-p-tolyl-p-phenylenediamine, N-1,3-dimethylbutyl-N'-phenyl-p-phenylenediamine, N-1,4-dimethylpentyl-N'-phenyl-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-1-methylpropyl-N'-

phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, N,N'-bis-(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis-(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis-(1-methylpropyl)-p-phenylenediamine, N-phenyl-N'-(1,3-dimethylbutyl)-p-phenylenediamine; N-phenyl-N'-isopropyl-p-phenylenediamine;
5 N-phenyl-N'-(1-methylheptyl)-p-phenylenediamine; N-phenyl-N'-cyclohexyl-p-phenylenediamine; mixed diaryl-p-phenylenediamines; N,N'-bis(1-methylheptyl)-p-phenylenediamine; N-phenyl-N'-p-toluenesulfonyl-p-phenylenediamine; N-phenyl-N'-alkyl-p-phenylenediamine and combinations thereof.

10 3. The antiozonant mixture of Claim 1 wherein the ketone is selected from the group consisting of methyl ethyl ketone, diethyl ketone, methyl propyl ketone, methyl isopropyl ketone, ethyl propyl ketone, ethyl isopropyl ketone, dipropyl ketone, diisopropyl ketone, methyl butyl ketone, methyl isobutyl ketone, methyl *sec* butyl ketone, methyl *tert*-butyl ketone, ethyl butyl ketone, ethyl isobutyl ketone, ethyl *sec*-butyl ketone,
15 ethyl *tert*-butyl ketone, propyl butyl ketone, isopropyl butyl ketone, propyl isobutyl ketone, propyl *sec*-butyl ketone, propyl *tert* butyl ketone, isopropyl isobutyl ketone, isopropyl *sec*-butyl ketone, isopropyl *tert*-butyl ketone, dibutyl ketone, diisobutyl ketone, di-*sec*-butyl ketone, di-*tert*-butyl ketone, butyl isobutyl ketone, butyl *sec*-butyl ketone, butyl *tert*-butyl ketone, isobutyl *sec*-butyl ketone, isobutyl *tert*-butyl ketone, *sec*-butyl
20 *tert*-butyl ketone, 5-heptanone, 5-methyl-2-hexanone, 4-methyl-2-hexanone, 3-methyl-2-hexanone, 3,4-dimethyl-2-pentanone, 3,3-dimethyl-2-pentanone, 4,4-dimethyl-2-

pentanone, 3-octanone, 4-methyl-3-heptanone, 5-methyl-3-heptanone, 6-methyl-3-heptanone, 4,4-dimethyl-3-hexanone, 4,5-dimethyl-3-hexanone, 5,5-dimethyl-3-hexanone, 4-nonanone, 5-methyl-4-octanone, 6-methyl-4-octanone, 7-methyl-4-octanone, 5,5-dimethyl-4-neptanone, 5,6-dimethyl-4-heptanone, 6,6-dimethyl-4-heptanone, 2-undecanone, cyclopropanone, cyclobutanone, cyclopentanone, cyclohexanone, cycloheptanone, cyclooctanone, cyclononanone, cyclodecanone, cycloundecanone, cyclododecanone and combinations thereof.

4. The antiozonant mixture of Claim 1 wherein the aldehyde is selected from the group consisting of formaldehyde acetaldehyde, propionaldehyde, butyraldehyde, 2-methylpropionaldehyde, valeraldehyde, 2-methyl-butanal, caproaldehyde, hexaldehyde, heptaldehyde, octaldehyde, nonaldehyde, decaldehyde, undecaldehyde, dodecaldehyde, benzaldehyde, phenylacetaldehyde and combinations thereof.

5. The antiozonant mixture of Claim 1 wherein the molar ratio of acetone to other carbonyl compound present in the carbonyl compound mixture is from about 1:99 to about 75:25.

6. The antiozonant mixture of Claim 1 wherein the molar ratio of acetone to other carbonyl compound present in the carbonyl compound mixture is from about 10:90 to about 50:50.

5 7. The antiozonant mixture of Claim 1 wherein the paraphenylene-diamine is selected from the group consisting of paraphenylenediamine, paraaminodiphenylamine and the carbonyl compound mixture is formed from acetone and methyl ethyl ketone, cyclopentanone, cyclohexanone, methylisobutyl ketone and methylisocamyl ketone.

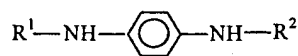
10 8. The antiozonant mixture of Claim 1 wherein the molar ratio of the carbonyl compound mixture to the paraphenylenediamine compound is from about 1.2:1.

15 9. The antiozonant mixture of Claim 1 wherein the reductive alkylation catalyst is a Group VIII metal.

20 10. The antiozonant mixture of Claim 9 wherein the Group VIII metal is selected from the group consisting of platinum, palladium, rhodium, ruthenium, nickel, cobalt and their sulfides.

11. The antiozonant mixture of Claim 1 wherein the reductive alkylation catalyst is platinum sulfide.

12. A rubber composition comprising (a) a rubber component; and, (b) a liquid antiozonant mixture obtained from the process comprising simultaneously reacting at least one unsubstituted and/or substituted paraphenylenediamine compound of the general formula



wherein R^1 and R^2 are the same or different and are hydrogen, a branched or straight chain alkyl, alkenyl, alkoxy, aralkyl, alkaryl, hydroxyalkyl or heterocyclic; with a carbonyl compound mixture comprising acetone and at least one other carbonyl compound selected from the group consisting of ketones containing from 4 to about 12 carbon atoms, aldehydes containing from 1 to about 12 carbon atoms and mixtures thereof in the presence of a reductive alkylation catalyst.

13. The rubber composition of Claim 12 wherein the rubber component is selected from the group consisting of natural rubber, homopolymers of conjugated diolefins, copolymers of conjugated diolefins and ethylenically unsaturated monomers and mixtures thereof.

14. The rubber composition of Claim 12 wherein the paraphenylenediamine compound is selected from the group consisting of paraphenylenediamine, paraaminodiphenylamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine; N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N-di-beta-naphthyl-p-phenylenediamine, N-o-tolyl-N'-phenyl-p-phenylenediamine, N,N-di-p-tolyl-p-phenylenediamine, N-1,3-dimethylbutyl-N'-phenyl-p-phenylenediamine, N-1,4-dimethylpentyl-N'-phenyl-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-1-methylpropyl-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, N,N'-bis-(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis-(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis-(1-methylpropyl)-p-phenylenediamine, N-phenyl-N'-(1,3-dimethylbutyl)-p-phenylenediamine; N-phenyl-N'-isopropyl-p-phenylenediamine; N-phenyl-N'-(1-methylheptyl)-p-phenylenediamine; N-phenyl-N'-cyclohexyl-p-phenylenediamine; mixed diaryl-p-phenylenediamines; N,N'-bis(1-methylheptyl)-p-phenylenediamine; N-phenyl-N'-p-toluenesulfonyl-p-phenylenediamine; N-phenyl-N'-alkyl-p-phenylenediamine and combination thereof.

15. The rubber composition of Claim 12 wherein the ketone present in the carbonyl compound mixture is selected from the group consisting of methyl ethyl ketone, diethyl ketone, methyl propyl ketone, methyl isopropyl ketone, ethyl propyl ketone, ethyl isopropyl ketone, dipropyl ketone, diisopropyl ketone, methyl butyl ketone,

5 methyl isobutyl ketone, methyl *sec* butyl ketone, methyl *tert*-butyl ketone, ethyl butyl ketone, ethyl isobutyl ketone, ethyl *sec*-butyl ketone, ethyl *tert*-butyl ketone, propyl butyl ketone, isopropyl butyl ketone, propyl isobutyl ketone, propyl *sec*-butyl ketone, propyl *tert* butyl ketone, isopropyl isobutyl ketone, isopropyl *sec*-butyl ketone, isopropyl *tert*-butyl ketone, dibutyl ketone, diisobutyl ketone, di-*sec*-butyl ketone, di-*tert*-butyl ketone, butyl isobutyl ketone, butyl *sec*-butyl ketone, butyl *tert*-butyl ketone, isobutyl *sec*-butyl ketone, isobutyl *tert*-butyl ketone, *sec*-butyl *tert*-butyl ketone, 5-heptanone, 5-methyl-2-hexanone, 4-methyl-2-hexanone, 3-methyl-2-hexanone, 3,4-dimethyl-2-pentanone, 3,3-dimethyl-2-pentanone, 4,4-dimethyl-2-pentanone, 3-octanone, 4-methyl-3-heptanone, 5-methyl-3-heptanone, 6-methyl-3-heptanone, 4,4-dimethyl-3-hexanone, 4,5-dimethyl-3-hexanone, 5,5-dimethyl-3-hexanone, 4-nonanone, 5-methyl-4-octanone, 6-methyl-4-octanone, 7-methyl-4-octanone, 5,5-dimethyl-4-heptanone, 5,6-dimethyl-4-heptanone, 6,6-dimethyl-4-heptanone, 2-undecanone, cyclopropanone, cyclobutanone, cyclopentanone, cyclohexanone, cycloheptanone, cyclooctanone, cyclononanone, cyclodecanone, cycloundecanone, cyclododecanone and combinations thereof.

16. The rubber composition of Claim 12 wherein the aldehyde present in the carbonyl compound mixture is selected from the group consisting of formaldehyde acetaldehyde, propionaldehyde, butyraldehyde, 2-methylpropionaldehyde, valeraldehyde, 2-methyl-butanal, caproaldehyde, hexaldehyde, heptaldehyde, octaldehyde, nonaldehyde, decaldehyde, undecaldehyde, dodecaldehyde, benzaldehyde, phenylacetaldehyde and combinations thereof.

17. The rubber composition of Claim 12 wherein the molar ratio of acetone to other carbonyl compound present in the carbonyl compound mixture of the antiozonant mixture is from about 1:99 to about 75:25.

5 18. The rubber composition of Claim 12 wherein the molar ratio of acetone to other carbonyl compound present in the carbonyl compound mixture of the antiozonant mixture is from about 10:90 to about 50:50.

10 19. The rubber composition of Claim 12 wherein the molar ratio of the carbonyl compound mixture to the paraphenylenediamine compound present in the antiozonant mixture is from about 1.2:1.

15 20. The rubber composition of Claim 12 wherein the reductive alkylation catalyst is a Group VIII metal.

21. The rubber composition of Claim 20 wherein the Group VIII metal is selected from the group consisting of platinum, palladium, rhodium, ruthenium, nickel, cobalt and their sulfides.

20 22. The rubber composition of Claim 12 wherein the reductive alkylation catalyst is platinum sulfide.

23. The rubber composition of Claim 12 wherein the antiozonant mixture is present in an amount ranging from about 2 to about 6 parts per hundred parts of the polymer of the rubber component.

5 24. The rubber composition of Claim 12 which is a tire, motor mount, rubber brushing, power belt, printing roll, rubber shoe heel and sole, rubber floor tile, caster wheel, elastomer seal and gasket, conveyor belt cover, wringer, hard rubber battery case, automobile floor mat, truck mud flap, ball mill liner or windshield wiper blade.